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Research Abstracts

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CURRENT NACA REPORTS

NACA Rept. 1143

A VECTOR STUDY OF LINEARIZED SUPERSONIC FLOW APPLICATIONS TO NONPLANAR PROBLEMS. John C. Martin. 1953. ii, 34p. diagrs., tab. (NACA Rept. 1143. Formerly TN 2641)

A vector study of the partial-differential equation of steady linearized supersonic flow is presented. General expressions are derived which relate the velocity potential in the stream to the conditions on the disturbing surfaces. Problems concerning nonplanar systems are investigated, and methods are derived for the solution of some simple problems. The damping in roll is found for rolling tails consisting of four, six, and eight rectangular fins.

NACA Rept. 1152

THEORY AND PROCEDURE FOR DETERMINING LOADS AND MOTIONS IN CHINE-IMMERSED HYDRODYNAMIC IMPACTS OF PRISMATIC BODIES. Emanuel Schnitzer. 1953. ii, 29p. diagrs. (NACA Rept. 1152. Formerly TN 2813)

A theoretical method is derived for computing the motions and hydrodynamic loads during water landings of prismatic bodies involving appreciable immersion of the chines. A simplified method of computation covering flat-plate and V-bottom bodies with beam-loading coefficients greater than unity is given as a separate section. Comparisons of theory with experiment are presented as plots of impact lift coefficient and maximum draft-beam ratio against flight-path angle and as time histories of loads and motions. Fair agreement is found to exist for chine-immersed landings for angles of dead rise of 0° and 30°, beam-loading coefficients from 1 to 36.5, flight-path angles from 2° to 90°, and trims from 6° to 45°.

NACA Rept. 1154

ANALYSIS OF LANDING-GEAR BEHAVIOR. Benjamin Milwitzky and Francis E. Cook. 1953. iii, 45p. diagrs., photo., 3 tabs. (NACA Rept. 1154. Formerly TN 2755)

The behavior of the conventional oleo-pneumatic landing gear during impact is analyzed. The applicability of the analysis to actual landing gears is established by comparing calculated results with drop-test data. In addition to the more exact treatment, studies are made to determine the effects of variations in such parameters as the force-deflection characteristics of the tire, the orifice discharge coefficient, and the polytropic exponent for the air-compression process in the shock strut, which may not be known accurately in practical design problems. An investigation is also made to determine the extent to which representation of the system can be simplified and still yield useful results. Generalized solutions for the behavior of a simplified system, which may be useful in preliminary design, are presented for a wide range of landing-gear and impact parameters.

NACA Rept. 1159

IMPINGEMENT OF WATER DROPLETS ON WEDGES AND DOUBLE-WEDGE AIRFOILS AT SUPERSONIC SPEEDS. John S. Serafini. 1954. ii, 24p. diagrs. (NACA Rept. 1159. Formerly TN 2971)

An analytical solution has been obtained for the equations of motion of water droplets impinging on a wedge in a two-dimensional supersonic flow field with a shock wave attached to the wedge. The closed-form solution yields analytical expressions for the equation of the droplet trajectory, the local rate of impingement and the impingement velocity at any point on the wedge surface, and the total rate of impingement. The analytical expressions are utilized to determine the impingement on the forward surfaces of diamond airfoils in supersonic flow fields with attached shock waves. The results presented include the following conditions: droplet diameters from 2 to 100 microns, pressure altitudes from sea level to 30,000 feet, free-stream static temperatures from 420° to 460° R, free-stream Mach numbers from 1.1 to 2.0, semiapex angles for the wedge from 1.14° to 7.97°, thickness-to-chord ratios for the diamond airfoil from 0.02 to 0.14, chord lengths from 1 to 20 feet, and angles of attack from zero to the inverse tangent of the airfoil thickness-to-chord ratio.

NACA RM A54I23

A HEATED-WIRE LIQUID-WATER-CONTENT INSTRUMENT AND RESULTS OF INITIAL FLIGHT TESTS IN ICING CONDITIONS. Carr B. Neel. January 1955. 33p. diagrs., photos., tab. (NACA RM A54I23)

A flight model of the heated-wire instrument was tested in natural icing conditions, and was shown to provide reliable measurements of liquid-water content. The rapid response of the instrument enabled detailed study of cloud structure. Cloud-duct tests showed measurements could be made up to 700 mph. Results of the flight measurements substantiated the high values of water content previously predicted. The highest value measured was 3.7 grams per cubic meter.

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NACA TM 1354

GENERAL THEORY OF CONICAL FLOWS AND ITS APPLICATION TO SUPERSONIC AERODYNAMICS. (La théorie générale des mouvements coniques et ses applications a l'aérodynamique supersonique). Paul Germain. PREFACE. M. J. Peres. January 1955. vii, 333p. diagrs. (NACA TM 1354. Trans. from Office National d'Études et de Recherches Aéronautiques, Pub. 34, 1949)

The report deals with a method of studying the equation of cylindrical waves particularly indicated for the solution of certain aerodynamic problems. The method reduces problems of a hyperbolic equation to problems of harmonic functions. The study has been applied toward setting up the fundamental principles, to developing their investigation up to calculation of the pressures on the visualized obstacles, and to showing how the initial field of "conical flows" was considerably enlarged by a procedure of integral superposition.

NACA TN 3149

PREDICTION OF LOSSES INDUCED BY ANGLES OF ATTACK IN CASCADES OF SHARP-NOSED BLADES FOR INCOMPRESSIBLE AND SUBSONIC COMPRESSIBLE FLOW. James J. Kramer and John D. Stanitz. January 1955. 45p. diagrs. (NACA TN 3149)

A method of computing the losses in total pressure caused by a nonzero angle of attack at the inlet to a row of sharp-nosed blades is developed for both incompressible and subsonic compressible flow. The results of the analysis indicate for the range of variables considered that increases in upstream flow angle cause sharp rises in total-pressure loss coefficient and corresponding drops in static-pressure coefficient for negative angles of attack, but for positive angles of attack and upstream flow angles less than 60° there is little variation in total-pressure loss coefficient with upstream flow angle.

NACA TN 3264

STUDY OF THE MOMENTUM DISTRIBUTION OF TURBULENT BOUNDARY LAYERS IN ADVERSE PRESSURE GRADIENTS. Virgil A. Sandborn and Raymond J. Slogar. January 1955. 79p. diagrs., photos. (NACA TN 3264)

Experimental evaluation and analysis were made of mean and turbulent terms of the equations of motion and the stress tensor at four stations in a turbulent boundary layer with a progressively increasing adverse pressure gradient. Evaluation of terms of the stress tensor indicated that $\rho\overline{v^2}$, $\rho\overline{w^2}$, and $-\rho\overline{uv}$ are of equal order of magnitude, while $\rho\overline{u^2}$ is roughly four times larger near the wall. The term $\frac{\partial v^2}{\partial y}$ of the y-direction equation of motion was found to be as large as any term of the x-direction equation.

NACA TN 3266

EXPERIMENTAL EVALUATION OF MOMENTUM TERMS IN TURBULENT PIPE FLOW. Virgil A. Sandborn. January 1955. 40p. diagrs. (NACA TN 3266)

Terms of the longitudinal- and radial-direction turbulent momentum equations were experimentally evaluated in a 4-inch-diameter pipe from total- and static-pressure data and hot-wire anemometer surveys. Terms of the r-direction momentum equation were found to be as large as terms of the x-direction equation. Direct comparisons were made with turbulence measurements obtained using the constant-current and constant-temperature systems of hot-wire anemometry. The two systems agree equally well within the experimental accuracy of the measurements.

NACA TN 3311

DESCRIPTION AND ANALYSIS OF A ROCKET-VEHICLE EXPERIMENT ON FLUTTER INVOLVING WING DEFORMATION AND BODY MOTIONS. H. J. Cunningham and R. R. Lundstrom. January 1955. 26p. diagrs., photos., 2 tabs. (NACA TN 3311. Formerly RM L50I29)

Flight tests and a mathematical analysis were carried out to demonstrate and confirm a type of subsonic flutter involving rigid-body motions and wing deformations. For the configuration considered, the period of the oscillation was approximately 100 chords per cycle which is well within the range of period found in dynamic-stability work on rigid aircraft with free controls. A mathematical analysis based on two-dimensional incompressible flow provided a conservative prediction of the airspeed at which the low-frequency flutter occurred. Wing-bending stiffness is the important parameter for preventing such flutter.

NACA TN 3318

ON THE SMALL-DISTURBANCE ITERATION METHOD FOR THE FLOW OF A COMPRESSIBLE FLUID WITH APPLICATION TO A PARABOLIC CYLINDER. Carl Kaplan. January 1955. 36p. diagrs., tab. (NACA TN 3318)

The Prandtl-Busemann small-disturbance method is applied to a parabolic cylinder and compared with the Janzen-Rayleigh or M_{∞}^2-expansion solution for the same shape. As expected, the small-disturbance and M_{∞}^2-expansion developments are but two different arrangements of the actual solution. Notwithstanding this agreement, it is concluded that the curtailed small-disturbance solution is not suitable for the calculation of subsonic flow past a shape (like the parabolic cylinder) which does not possess a control parameter such as, for example, a thickness coefficient. The small-disturbance solution for the parabolic cylinder is examined from the point of view of thin-airfoil theory. The series development of the fluid speed at the surface in powers of the ratio of the radius of curvature of the vertex and the abscissa measured from the vertex agrees with the results of second-order thin-airfoil theory.

NACA TN 3323

CHARTS FOR ESTIMATING PERFORMANCE OF HIGH-PERFORMANCE HELICOPTERS. Alfred Gessow and Robert J. Tapscott. January 1955. 36p. diagrs. (NACA TN 3323)

Theoretically derived charts are presented for use in predicting profile-drag—thrust ratios of rotors having hinged blades with -8° twist. The charts are considered applicable to rotor-operating conditions

in which high tip-speed ratios or large rotor angles of attack are encountered; however, they do not include the effects of compressibility. Limit lines showing the conditions of onset of stall are included in the charts, and the effects of blade twist on the stall limits are discussed.

NACA TN 3324

A NOTE ON THE DRAG DUE TO LIFT OF RECTANGULAR WINGS OF LOW ASPECT RATIO. Edward C. Polhamus. January 1955. 24p. diagrs. (NACA TN 3324)

Methods of estimating the induced drag of low-aspect-ratio wings are discussed and compared with experiment. The profile drag due to lift is also discussed and a method is developed which relates the effect of aspect ratio on the profile drag due to lift to an "effective" two-dimensional lift coefficient. A simple expression for this effective two-dimensional lift coefficient in terms of the aspect ratio is derived and used to correlate experimental values of profile drag due to lift for rectangular wings in the low-aspect-ratio range.

NACA TN 3331

ANALYSIS OF LAMINAR FORCED-CONVECTION HEAT TRANSFER IN ENTRANCE REGION OF FLAT RECTANGULAR DUCTS. E. M. Sparrow. January 1955. 42p. diagrs. (NACA TN 3331)

The simultaneous development of temperature and velocity profiles in the entrance region of a flat rectangular duct is studied. The flow is laminar with constant properties and negligible dissipation. Two thermal conditions for the duct walls are considered: (1) both walls have the same uniform temperature throughout; (2) one wall is at uniform temperature, the other wall is insulated. Thermal and velocity boundary layers are calculated using the Kármán-Pohlhausen method. Nusselt numbers are reported for Prandtl number in the range 0.01 to 50. For simultaneously developing profiles, the Nusselt number is found not to be a function at Graetz number alone, as it is for an unchanging parabolic velocity profile throughout.

NACA TN 3335

METHODS FOR RAPID GRAPHICAL EVALUATION OF COOLED OR UNCOOLED TURBOJET AND TURBOPROP ENGINE OR COMPONENT PERFORMANCE (EFFECTS OF VARIABLE SPECIFIC HEAT INCLUDED). Jack B. Esgar and Robert R. Ziemer. January 1955. 45p. diagrs. (NACA TN 3335)

Curves based on the thermodynamic properties of air and combustion gases for a hydrogen-carbon ratio of 0.167 are presented to relate parameters affecting each engine component. The curves cover a range of flight Mach numbers from 0 to 3.0, compressor pressure ratios from 1 to 30, turbine-inlet temperatures from 1500° to 3000° R, and afterburner temperatures from 2800° to 3500° R. Except for extreme cases, the curves are accurate to at least 3° R in temperature and 1 percent in pressure ratio, fuel-air ratio, and specific thrust. Procedures required for performance evaluation are explained for both uncooled engines with no compressor bleed and for engines utilizing both compressor bleed and turbine cooling.

NACA TN 3337

INVESTIGATION OF TEMPERATURE LIMITATION OF VARIOUS LUBRICANTS FOR HIGH-TEMPERATURE 20-MILLIMETER-BORE BALL BEARINGS. Z. N. Nemeth and W. J. Anderson. January 1955. 31p. diagrs., photos., 2 tabs. (NACA TN 3337)

Twenty-millimeter-bore tool-steel ball bearings, equipped with either a beryllium copper or an Inconel cage, were operated with liquid and with solid lubricants at temperatures from 100° to 1000° F at a speed of 2500 rpm and a thrust load of 110 lb. Solid lubricants were more effective than fluid lubricants at the higher temperatures. Graphite provided effective lubrication to 1000° F with bearings equipped with either a beryllium copper or an Inconel cage; molybdenum disulfide, to 850° F with a bearing equipped with an Inconel cage. A silicone-diester blend, the best high-temperature liquid lubricant, provided effective lubrication to 700° F and allowed operation of the bearing at 850° F although the bearing operation was rough and friction torque was high.

NACA TN 3346

PREDICTION OF DOWNWASH BEHIND SWEPT-WING AIRPLANES AT SUBSONIC SPEED. John DeYoung and Walter H. Barling, Jr. January 1955. 104p. diagrs., 3 tabs. (NACA TN 3346)

The numerical integration method presented enables a rapid prediction of downwash. The principal effects of the rolling-up of the wake are treated as corrections to the flat-sheet wake. A simple approximate correction for the effect of the fuselage is applied. Computing forms and charts of pertinent functions are included. Agreement with available experimental data is good.

NACA TN 3353

EFFECTIVE MOMENT OF INERTIA OF FLUID IN OFFSET, INCLINED, AND SWEPT-WING TANKS UNDERGOING PITCHING OSCILLATIONS. James R. Reese and John L. Sewall. January 1955. 27p. diagrs., 6 tabs. (NACA TN 3353)

Fluid-dynamics studies were made of simplified model fuel tanks undergoing pitching oscillations. The tanks were pylon mounted, centrally mounted at angles of sweep, and inclined at angles of attack. The effective moment of inertia of the fluid was determined experimentally for the various tank configurations over a tank-fullness range from empty to full. For full pylon-mounted and swept-wing tanks, comparisons of experimental and theoretical solutions for the effective moment of inertia of fluid showed good agreement. Studies of the effect of vertical, horizontal, and diffused baffles in pylon-mounted tanks showed that the effective moment of inertia of the fluid was considerably less without baffles. Diffused baffles were found to have high damping characteristics in pylon-mounted tanks and very low damping characteristics in centrally mounted tanks.

NACA TN 3356

EFFECT OF LAG OF SIDEWASH ON THE VERTICAL-TAIL CONTRIBUTION TO OSCILLATORY DAMPING IN YAW OF AIRPLANE MODELS. Lewis R. Fisher and Herman S. Fletcher. January 1955. 38p. diagrs., photos. (NACA TN 3356)

Two models were tested which permitted, in effect, a systematic variation of the sidewash gradient at the vertical tail. For the first model, this variation was accomplished by mounting auxiliary fins forward of the vertical tail; for the second model, it was done by altering the vertical location of the wing on the fuselage. The unsteady damping-in-yaw and directional-stability parameters are compared with the steady derivatives obtained for the same models to establish the effects of the sidewash and the lag of the sidewash on these lateral stability derivatives.

NACA TN 3357

THE EFFECTS OF VARIOUS PARAMETERS, INCLUDING MACH NUMBER, ON PROPELLER-BLADE FLUTTER WITH EMPHASIS ON STALL FLUTTER. John E. Baker. January 1955. 40p. diagrs., 3 tabs. (NACA TN 3357. Formerly RM L50L12b)

The effect of many parameters significant to wing flutter as well as blade twist was studied on several untwisted rotating models to determine their significance with respect to propeller stall flutter. The minimum values of the flutter-speed coefficient were found to be slightly greater than 1.0 at subcritical Mach numbers. Of the few parameters that raised the minimum flutter-speed coefficients, forward movement of the section center-of-gravity location and Mach number at supercritical speeds were most significant. The effect of Mach number was of such significance that a tentative criterion for designing completely flutter-free thin supersonic propellers is indicated.

NACA TN 3360

SOME EFFECTS OF PROPELLER OPERATION AND LOCATION ON ABILITY OF A WING WITH PLAIN FLAPS TO DEFLECT PROPELLER SLIPSTREAMS DOWNWARD FOR VERTICAL TAKE-OFF. John W. Draper and Richard E. Kuhn. January 1955. 28p. diagrs., photo. (NACA TN 3360)

An investigation has been conducted of the effects of propeller blade angle, mode of propeller rotation, propeller location, and ratio of wing chord to propeller diameter on the ability of a wing with plain flaps to deflect the propeller slipstream downward in order to achieve vertical take-off. The basic model consisted of a semispan wing with 30-percent-chord and 60-percent-chord plain flaps. Two large-diameter overlapping propellers driven by electric motors were used.

NACA TN 3361

AERODYNAMIC CHARACTERISTICS OF NACA 0012 AIRFOIL SECTION AT ANGLES OF ATTACK FROM 0^{o} TO 180^{o}. Chris C. Critzos, Harry H. Heyson and Robert W. Boswinkle, Jr. January 1955. 21p. diagrs. (NACA TN 3361)

The aerodynamic characteristics of the NACA 0012 airfoil section are presented for an angle-of-attack range extending through 180^{o}. Data were obtained at a Reynolds number of 1.8×10^{6} with the airfoil surfaces smooth and with roughness applied at the leading and trailing edges and at a Reynolds number of 0.5×10^{6} with the airfoil surfaces smooth. The tests were conducted in the Langley low-turbulence pressure tunnel at Mach numbers no greater than 0.15.

NACA TN 3364

INVESTIGATION OF EFFECTIVENESS OF LARGE-CHORD SLOTTED FLAPS IN DEFLECTING PROPELLER SLIPSTREAMS DOWNWARD FOR VERTICAL TAKE-OFF AND LOW-SPEED FLIGHT. Richard E. Kuhn and John W. Draper. January 1955. 42p. diagrs., photo., tab. (NACA TN 3364)

An investigation of the effectiveness of a wing equipped with large-chord slotted flaps and an auxiliary vane in rotating the effective thrust vector of propellers to a near-vertical direction for vertical take-off and low-speed flight has been conducted. The model consisted of a semispan wing equipped with 60-percent-chord and 30-percent-chord slotted flaps. Two large-diameter overlapping propellers, driven by electric motors, were used. The effect of wing incidence, propeller blade angle, and an auxiliary vane on the ability of the wing equipped with slotted flaps to deflect the propeller slipstreams downward were also investigated. A few tests covered an angle-of-attack range from 0^{o} to 90^{o} and a thrust-coefficient range representing free-flight velocities from zero to the normal range of cruising velocity.

NACA TN 3366

A METHOD FOR STUDYING THE TRANSIENT BLADE-FLAPPING BEHAVIOR OF LIFTING ROTORS AT EXTREME OPERATING CONDITIONS. Alfred Gessow and Almer D. Crim. January 1955. 27p. diagrs. (NACA TN 3366)

A method is presented for studying the transient behavior of the flapping motion, as well as for calculating the steady-state flapping amplitudes, of free-to-cone and seesaw rotors operating at extreme flight conditions. The method is general and can be applied to blades of any airfoil section, mass distribution, twist, plan-form taper, root cutout, and flapping-hinge geometry. Stall and compressibility effects can also be accounted for. Applications of the method to the calculation of the stability of the flapping motion of unloaded rotors and to the transient blade motion resulting from arbitrary control inputs under conditions of extreme stall are included.

NACA TN 3387

USE OF NONLINEARITIES TO COMPENSATE FOR THE EFFECTS OF A RATE-LIMITED SERVO ON THE RESPONSE OF AN AUTOMATICALLY CONTROLLED AIRCRAFT. Stanley F. Schmidt and William C. Triplett. January 1955. 27p. diagrs., tab. (NACA TN 3387)

A method is developed for designing suitable nonlinear functions of error into a system to compensate for the undesirable effects of control-surface rate limiting on the response of an automatically controlled aircraft.

BRITISH REPORTS

N-34602*

Aeronautical Research Council (Gt. Brit.)
THE EFFICIENCY OF HIGH-SPEED WIND TUNNELS OF THE INDUCTION TYPE. A. E. Knowler and D. W. Holder. APPENDIX - THE EFFICIENCY OF INTERMITTENT OPERATION FROM COMPRESSED AIR STORAGE. D. W. Holder. 1954. iii, 59p. diagrs., photo., 6 tabs. (ARC R & M 2448. Formerly ARC 7563; 7672; 7756; 7812; 8024; 8138; 8394; 8668; 8669; 8670; 9490 and 9902)

An investigation has been made of the influence of various design features upon the efficiency of an induction-type tunnel with an annular injector slot. A model tunnel of circular cross-section was used, the working-section diameter being 2-1/4 inch. At subsonic working-section speeds it was found that efficiencies comparable with those of direct-action tunnels could be attained, but at supersonic speeds the efficiency began to fall rapidly. A comparison between the 2-1/4 inch and 12 inch tunnels is made.

N-34603*

Aeronautical Research Council (Gt. Brit.)
ASSESSMENT OF THE RELATIVE PERFORMANCE OF THE BY-PASS ENGINE AND THE ORTHODOX DOUBLE COMPOUND JET ENGINE. E. A. Bridle. 1954. 12p. diagrs. (ARC R & M 2862; ARC 11,740. Formerly NGTE Memo. M. 32)

The by-pass engine can be described as a form of ducted fan engine in which the fan boosts the main compressor. Two possible forms of by-pass engine are described, and their estimated performance is compared with that of the orthodox double compound jet engine under various flight conditions, the calculations being extended to include the case of thrust boosting by means of exhaust reheat. It is concluded that the by-pass engine can offer an appreciable gain in respect of fuel economy over the orthodox double compound jet engine even at 650 mph in the stratosphere, at the expense, however, of increased frontal area for a given thrust.

N-34604*

Aeronautical Research Council (Gt. Brit.)
FULL-SCALE MEASUREMENTS OF IMPACT LOADS ON A LARGE FLYING BOAT. PART 1. DESCRIPTION OF APPARATUS AND INSTRUMENT INSTALLATION. J. W. McIvor. 1954. 27p. photos., diagrs. (ARC CP 182)

The variations with time of the total force and the distribution of water pressures on the hull bottom of a flying boat are related to the horizontal velocity, vertical velocity and keel attitude relative to the water during impact. Methods are described for obtaining, in a form suitable for easy analysis of results, records of these variables, in order to verify impact theories. The equipment used included transducers for the conversion of physical quantities to electrical signals, multichannel electronic amplifiers, and mirror galvanometer recorders.

N-34605*

Aeronautical Research Council (Gt. Brit.)
THE EFFECT OF INLET CONDITIONS ON THE FLOW IN ANNULAR DIFFUSERS. I. H. Johnston. 1954. 15p. diagrs. (ARC CP 178)

Tests have been carried out on annular diffusers having a common area ratio of 3.19 and varying in divergence angle from 6.5° to 15°. The performance of each diffuser has been measured for a variety of inlet velocity distributions and the effect of axially splitting the flow in the diffusers has been investigated. Diffuser efficiency is found to deteriorate as inlet conditions become nonuniform, this tendency increasing with diffuser angle. Splitting of the higher angle diffusers improves efficiency for nonuniform profiles, but these increases in efficiency are accompanied by pronounced static pressure gradients across the diffuser throat which in certain applications might prove undesirable.

N-34606*

Aeronautical Research Council (Gt. Brit.)
A METHOD OF COMPUTING SUBSONIC AND TRANSONIC PLANE FLOWS. C. S. Sinnott. 1954. 21p. diagrs., photos. (ARC CP 173)

A relaxation treatment of a simple but exact differential equation for compressible flow is presented. The method has advantages over other numerical treatments of the same problem and because of the simplicity of the basic differential equation should be particularly suitable for high-speed computing machines. The flow about a 10-percent-thick airfoil (RAE 104) at zero incidence is calculated for Mach numbers fo 0.70, 0.79, and 0.86. At M = 0.86 the existence, but not the position of a transonic shock wave is predicted by the retaxation technique. Satisfactory agreement with experiment is obtained.

N-34607*

Aeronautical Research Council (Gt. Brit.)
THE THEORETICAL INTERFERENCE VELOCITY ON THE AXIS OF A TWO-DIMENSIONAL WIND TUNNEL WITH SLOTTED WALLS. R. C. Tomlinson. 1954. 15p. diagrs., 2 tabs. (ARC CP 181)

A calculation is made of the interference velocity on the axis in the flow of an incompressible fluid past a line doublet in a two-dimensional slotted-wall tunnel, i.e. a rectangular tunnel whose shorter sides are slotted in the direction on the flow. Numerical solutions are obtained which show that if the width of (slot + slat) is one twelfth of the tunnel height (e.g. six slots in the shorter side of a 2 by 1 tunnel), the interference velocity is little different from the corresponding open-jet value - i.e. no slats - for all slot/slat ratios greater than 1/40. It appears likely that all cases which give conditions uniform across the center plane of the tunnel will also give an interference velocity which is close to the open jet figure.

N-34608*

Aeronautical Research Council (Gt. Brit.)
THE M. A. E. E. RECORDING ACCELEROMETER. D. M. Ridland and R. Parker. 1954. 20p. photos., diagrs. (ARC CP 177)

The M. A. E. E. recording accelerometer is basically the accelerometer unit of a desynn accelerometer, adapted to make a continuous and immediate presentation of accurate, calibrated accelerations on a half second time base. The recording medium is metallized paper, having a speed of half an inch per second, and the instrument can be operated continuously for 20 minutes on one loading. It can record with full scale deflections, from 1 to 10gg when the natural frequencies will be about 7 and 22 cps, respectively. The instrument is simple, it has been proved reliable and accurate and is most convenient in use.

N-34616*

Nat. Gas Turbine Establishment (Gt. Brit.)
THERMODYNAMIC PROPERTIES OF AIR AND COMBUSTION PRODUCTS OF HYDROCARBON FUELS. PART III. THE FLOW OF GASES OF VARYING SPECIFIC HEAT. D. Fielding, J. E. C. Topps and W. R. Thomson. June 1954. 43p. diagrs. (NGTE R. 160)

General methods of calculating gas flow have been investigated and it has been found possible to present data in graphical form which permits the frictionless flow properities of ideal gases of varying specific heat and any molecular weight to be calculated at velocities up to sonic with error not exceeding that inherent in the approximation to four significant figures. Charts are presented of a total head flow parameter against pressure ratio, pressure ratio against temperature ratio, and Mach number against temperature ratio, all with molar specific heat as a running parameter. The relations are also given for Mach numbers 1.0 to 3.0.

N-34617*

Nat. Gas Turbine Establishment (Gt. Brit.)
TESTS TO DETERMINE THE EFFECT OF THE EXHAUST CONE SUPPORT STRUT FAIRINGS ON THE PERFORMANCE OF A TURBO-JET ENGINE. W. Deacon. July 1954. 19p. diagrs. (NGTE Memo. M. 222)

Simple bench tests have been made to determine what effect the exhaust cone support strut fairings have on the performance of a turbojet engine. Pitot and yawmeter traverses were made just downstream of the turbine. The results show that some residual swirl is present in the turbine exhaust, and that the fairings effectively remove it. Removal of the strut fairings causes an increase in exhaust losses, mainly due to the increased swirl in the exhaust system, but also due to the exposure of unfaired support rods. The increased loss due to swirl is in accordance with that predicted from model tests. When the fairings are removed, removal of the bullet causes no further increase in exhaust losses.

N-34619*

Nat. Gas Turbine Establishment (Gt. Brit.)
SOME CALCULATIONS ON IDEAL COMBUSTION IN A PARALLEL DUCT. A. B. P. Beeton. July 1954. 25p. diagrs. (NGTE Memo. M. 221)

Taking one typical case representative of ram-jet combustion conditions, calculations were made of the integrated kinetic energy and throat specific impulse after loss-free combustion in a parallel duct. Various inlet flow velocities were considered, corresponding to downstream throat areas between 83-1/2 percent and 95-1/2 percent of the duct area. Comparing these results with those calculated for the same approach velocities on the usual basis of homogeneous flow, the latter are shown to involve a loss in specific impulse of at most half a second in 150. The corresponding kinetic energies were not calculated with sufficient accuracy to obtain more than the order of the loss, which appeared to be about half the energy in the approach flow.

N-34621*

Nat. Gas Turbine Establishment (Gt. Brit.)
THE EFFECT OF BURNER SHROUD AIR ON A FUEL SPRAY. H. Clare. July 1954. 25p. diagrs., photos. (NGTE Memo. M. 223)

The possibility of using shroud air as an atomization booster has been investigated. It was found to be effective only when the initial spray was coarse. Drop size analyses of sprays produced from swirl atomizers at low fuel pressures showed that at low shroud air pressure swirling air was the more effective. At higher air pressures of 20 in. water the effects of both swirled and unswirled air were similar. The difference between the swirled and unswirled air was most marked at a pressure of 2 in. head of water where the swirling air improved atomization, whilst unswirled air produced a still coarser spray. It is concluded that swirling shroud air could be used to advantage where both fuel and shroud air pressures were low, a condition which might be expected in an aircraft combustion chamber idling at altitude.

N-34623*

Nat. Gas Turbine Establishment (Gt. Brit.)
A CORRECTED SPEED TACHOSCOPE. R. Staniforth. May 1954. 15p. diagrs., photos. (NGTE Memo. M.217)

It is often desirable in testing aerodynamic compressors to take all readings at fixed corrected speeds rather than true speeds. This corrected speed is defined as the actual shaft speed divided by the square root of the ratio of the absolute air inlet temperature to the standard temperature (288° K.). With the instrument described, this is possible with high accuracy (error < 0.1 percent) without further complication than the setting of a dial to the observed air inlet temperature. . The latter operation could be dispensed with and the correction obtained directly from a temperature sensitive device such as a thermistor or a resistance thermometer element.

N-34627*

Marine Aircraft Experimental Establishment (Gt. Brit.) SOME ASPECTS OF THE FLOW ROUND PLANING SEAPLANE HULLS OR FLOATS AND IMPROVEMENT IN STEP AND AFTERBODY DESIGN. K. M. Tomaszewski and A. G. Smith. September 1954. 13p. diagrs., photo. (MAEE F/TN/4; ARC 14,376; ARC S. 669. Formerly MAEE Tech. Memo 5)

A method of step and afterbody design is given and illustrated which is based on knowing the shape of the wake produced by the forebody and the interactlon

between air and water flow under the afterbody. It is claimed that this is a logical approach which gives the designer a clear overall picture of the physical conditions existing during take-off and landing, enabling the optimum aero- and hydrodynamic performance to be quickly obtained. Application leads to large improvements in air and water drag and in water stability.

N-34628*

Royal Aircraft Establishment (Gt. Brit.)
CALIBRATION OF THE FLOW IN THE WORKING SECTION OF THE 3 FT. x 3 FT. TUNNEL, NATIONAL AERONAUTICAL ESTABLISHMENT. D. E. Morris. September 1954. 44p. diagrs. (RAE Tech. Note Aero 2336)

A number of calibrations, consisting of both pitot and static pressure measurements and also flow direction measurements, have been made of the flow in the working section of the 3-ft by 3-ft supersonic tunnel. In this report some selected examples are given to show the general nature of the flow distribution with the M = 1.4, 1.6, 1.8, and 2.0 nozzles and to demonstrate a number of interesting points in the measurements and in the characteristics of the flow.

N-34630*

Ministry of Supply (Gt. Brit.)
REPORT ON PROGRESS IN THE DEVELOPMENT OF AN ALLOYING THEORY OF TITANIUM. Dept. of Physical Metallurgy, Birmingham University. (Progress report 1951-1954 of the titanium research programme) November 1954. 28p. diagrs., photos. (MOS S & TM 13/54)

In this report an attempt has been made to summarize those properties of titanium and its alloys which would appear to have some significant relationship to the electronic structure of the metal and to put forward tentative suggestions for possible causes of the observed behavior of its alloys.

N-34631*

Ministry of Supply (Gt. Brit.)
DIFFUSION OF SOLUTE ELEMENTS IN TITANIUM. D. H. Tomlin and A. J. Mortlock. (Biannual progress report no. 1 for April-October 1954). November 1954. 6p. diagrs. (MOS S & TM 14/54)

The initial part of a general study of the diffusion of solute elements in titanium reported here has been aimed at experimentally determining the diffusion parameters associated with the movements of chromium in β-titanium. A new method is described which makes use of autoradiographic techniques, and which suggests that a number of diffusion coefficients corresponding to different temperatures may be determined using the same specimen.

MISCELLANEOUS

NACA Rept. 1152

Errata on "THEORY AND PROCEDURE FOR DETERMINING LOADS AND MOTIONS IN CHINE-IMMERSED HYDRODYNAMIC IMPACTS OF PRISMATIC BODIES." Emanuel Schnitzer. 1953.

NACA Rept. 1159

Errata on "IMPINGEMENT OF WATER DROPLETS IN WEDGES AND DOUBLE-WEDGE AIRFOILS AT SUPERSONIC SPEEDS." John S. Serafini. 1954.

N-33959*

Advisory Group for Aeronautical Research and Development. A SUMMARY OF THE TECHNIQUES OF VARIABLE MACH NUMBER SUPERSONIC WIND TUNNEL NOZZLE DESIGN. J. T. Kennedy and L. M. Webb. October 1954. 133p. diagrs., photos. (AGARDograph 3)

This report is a survey of the techniques of two-dimensional wind-tunnel nozzle design. A procedure for the aerodynamic design of flexible nozzles capable of continuous Mach number variation is developed in detail. The special structural, mechanical, calibration, and cost estimation problems involved in flexible nozzle construction are discussed.

N-35025*

Advisory Group for Aeronautical Research and Development. METHODS AND CRITERIA FOR THE SELECTION OF FLYING PERSONNEL. (Symposium held February 23-25, 1953, Paris) December 1954. 59p. (AGARDograph 2)

Original papers and summaries of the symposium covering three different aspects of the problem: (1) psychological and psychiatric methods of selection and assessment of flying personnel; (2) clinical selection criteria and methods; (3) physiological selection criteria and methods are presented.

DECLASSIFIED NACA REPORTS

NACA RM L7L12

MEASUREMENTS OF THE WING AND TAIL LOADS DURING THE ACCEPTANCE TESTS OF BELL XS-1 RESEARCH AIRPLANE. De E. Beeler and John P. Mayer. April 13, 1948. 25p. diagrs., photos., 2 tabs. (NACA RM L7L12) (Declassified from Confidential, 12/10/54)

During the acceptance tests of the XS-1 airplane, strain-gage measurements were made of wing and tail loads up to a Mach number of 0.80. The maximum lift and buffet boundaries were also determined. The loads encountered were well within the design loads and showed fairly good agreement with wind-tunnel and calculated data.

NACA RM L8A09

GENERAL HANDLING-QUALITIES RESULTS OBTAINED DURING ACCEPTANCE FLIGHT TESTS OF THE BELL XS-1 AIRPLANE. Walter C. Williams, Charles M. Forsyth and Beverly P. Brown. April 19, 1948. 72p. diagrs., photos., tab. (NACA RM L8A09) (Declassified from Confidential, 12/10/54)

Presents results obtained during acceptance tests of the Bell XS-1 airplane from minimum speed to a Mach number of 0.8. The longitudinal stability was positive but low for all conditions tested. The directional stability was exceptionally high, and the lateral stability was positive throughout the speed range tested. Aileron control was adequate. The stalling characteristics were considered satisfactory with stall warning in the form of buffeting. The large amount of friction in the control system, coupled with low control-operating forces, made exact control of the airplane difficult.

NACA RM L50J27

STABILITY AND CONTROL CHARACTERISTICS OF A 1/4-SCALE BELL X-5 AIRPLANE MODEL IN THE LANDING CONFIGURATION. Robert E. Becht. December 18, 1950. 38p. diagrs., photos. (NACA RM L50J27) (Declassified from Confidential, 10/29/54)

An investigation was conducted to determine the stability and control characteristics of a 1/4-scale model of a preliminary Bell X-5 airplane design in the landing configuration with and without dive brakes. Tests were made at wing sweep angles of 20° and 60°.

NACA RM L50K30

THE ORIGIN OF AERODYNAMIC INSTABILITY OF SUPERSONIC INLETS AT SUBCRITICAL CONDITIONS. Antonio Ferri and Louis M. Nucci. January 26, 1951. 111p. diagrs., photos., tab. (NACA RM L50K30) (Declassified from Confidential, 1/11/55)

The starting of "buzz" is explained as being caused by a separation on the inner surface of the cowling produced by a velocity discontinuity across a vortex sheet arising from a shock intersection. The explanation has been confirmed by tests of a number of inlet designs, and it has been shown that a useful range of stable flow regulation is attainable. Values of minimum stable entering volume flow for configurations of practical interest are presented for a range of Mach number from 1.90 to 2.70.

NACA RM L53E06a

SOME NOTES ON THE AERODYNAMIC LOADS ASSOCIATED WITH EXTERNAL-STORE INSTALLATIONS. H. Norman Silvers and Thomas C. O'Bryan. June 1953. 17p. diagrs. (NACA RM L53E06a) (Declassified from Confidential, 12/10/54)

The results of recent investigations of the aerodynamic loads associated with external stores are considered with a view toward indicating certain observations that may prove helpful in the design of future external store installations. Consideration was given to store-induced wing loads and to direct external store loads.

NACA RM L53G07

WIND-TUNNEL INVESTIGATION OF THE BEHAVIOR OF PARACHUTES IN CLOSE PROXIMITY TO ONE ANOTHER. Stanley H. Scher. August 1953. 12p. photos. (NACA RM L53G07) (Declassified from Confidential, 1/11/55)

An investigation made with small tethered parachutes in the Langley 20-foot free-spinning tunnel indicated that parachutes side by side had little effect on one another, but that when one parachute got into the wake above another parachute, the upper parachute sometimes collapsed on top of the lower parachute.